

environmental assessment
replace water distribution system

june 1984

GRAND CANYON
VILLAGE AREA



GRAND CANYON NATIONAL PARK / ARIZONA

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ENVIRONMENTAL ASSESSMENT
REPLACE WATER DISTRIBUTION SYSTEM, VILLAGE AREA

GRAND CANYON NATIONAL PARK

United States Department of the Interior
National Park Service
Denver Service Center

6/26/80
6/26/80

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10/25/1988

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PURPOSE OF AND NEED FOR ACTION

PROBLEM STATEMENT

The South Rim Village is the major developed area in Grand Canyon National Park. Most of the water mains in the older sections of the village are 40 to 50 years old, with some up to 80 years old. As a result of its age and general layout, the water distribution system for this area is inadequate, deteriorated, and substandard. The major deficiencies of the system include the following:

Due to the deteriorated condition of the older portions of the system, breaks are common and result in disruptions of service and costly repairs.

Unaccounted water represents a major portion of water consumption, with a substantial portion of this loss estimated to be from leaking lines.

Waterlines are inadequately sized for fire flows and increasing domestic demand.

Looping of waterlines is inadequate, resulting in inefficient water flow, stagnation, and reliance on a single, 8-inch waterline to provide water from storage to the lower pressure zone. If this

8-inch line should break, village water demand could not be fully met until this line was repaired.

Storage for fire flows is insufficient and water does not adequately circulate within the storage tanks, resulting in stagnation.

Silt and sedimentation enter the distribution system because the water supply line connects directly into the distribution system.

Portions of the system have water and sewer lines in a common trench, which is in violation of the Arizona State Department of Health and U.S. Public Health Service regulations. Known leakage from the older lines in a common trench poses serious potential health hazards to park visitors and residents.

The National Park Service proposes to improve the existing South Rim Village potable water distribution system. Implementation of this proposal would result in the following improvements:

Reduction of maintenance repair costs for the system and interruptions to service caused by waterline breaks and leakage

A substantial reduction in the loss of water due to leakage, resulting in water and energy savings

Provision of adequate capacity for fire flows and domestic demands

Improved water flow and elimination of reliance on a single 8-inch waterline from storage to the village by providing an additional line from storage to the lower pressure zone

Provision of adequate storage for fire flows and improved circulation within the water storage tanks

Reduction of silt and sedimentation in the distribution system by constructing a direct hookup from the supply line to storage

Elimination of potential health hazards by eliminating water and sewer lines from a common trench

Desert View is a small visitor complex approximately 25 miles east of the South Rim Village. A 16-mile waterline extends from the village storage tank farm to Desert View; the remaining 6 miles required to complete the line to Desert View has never been installed. All water for Desert View is currently being hauled 25 miles from the village maintenance area, which requires substantial annual operation and maintenance costs. Approximately \$33,000 was spent in 1982. These costs and the amount of time and number of water trucks along the East Rim Drive will be higher in the future because of increasing amounts of water used and increasing hauling costs.

The National Park Service also proposes to improve the water supply operation to Desert View in terms of convenience, annual expenses, and reduced water truck usage along the East Rim Drive.

INTERRELATIONSHIP WITH OTHER PROJECTS

Indian Gardens Water Supply Operations

The National Park Service proposes to increase the water supply capacity up to the South Rim from Indian Gardens (under Package No. 174) in 1988. Water conservation achieved through the implementation of the proposal to improve the South Rim Village water distribution system would be a consideration in evaluating alternatives for the Indian Gardens proposal.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

INTRODUCTION

The National Park Service proposes to improve the South Rim Village potable water distribution system and to improve the water supply operation to Desert View. Two alternatives are being considered for improvement of the village water distribution system. The first, a no-action alternative, would retain the existing system and current operation and maintenance practices would continue. The second alternative would include replacement of existing waterlines and construction of additional waterlines and storage facilities. Two options for the alignment of sections of the water distribution system that would be replaced along two residential streets (Apache and Boulder) are included under the second alternative.

Three alternatives are being considered for improvement of the Desert View water supply operation. Under a no-action alternative, water would continue to be hauled to Desert View from the village. Under the second alternative, a new loading station would be constructed below Buggeln Hill and the initial 13.7 miles of existing waterline to Desert View would be put into operation. Water would be hauled from Buggeln Hill to Desert View. Under alternative 3 the waterline would be completed to Desert View, eliminating the need to haul water.

In order to ascertain water hauling and/or pumping requirements for each of the Desert View alternatives, present and projected water demand at Desert View was determined. Annual water demand is based on facility expansion, water usage, and line leakage. Water requirements are discussed in appendix A.

SOUTH RIM VILLAGE WATER DISTRIBUTION SYSTEM ALTERNATIVES

Alternative 1 - No-Action

The no-action alternative provides for continued maintenance of the existing water distribution system by NPS maintenance personnel, but it does not include upgrading the system. Routine maintenance operations include repair or replacement of nonfunctioning components or broken lines within the system as required.

Present operation and maintenance practices would continue. However, maintenance operations would be expected to increase as unresolved problems remained or intensified due to continued deterioration of the existing system.

Alternative 2 - Improve the Water Distribution System (Preferred Alternative)

Alternative 2 would rehabilitate and upgrade the South Rim Village water distribution system. Major alterations to the system would include replacement of 3.9 miles of existing waterlines, construction of 7.2 miles of additional waterlines, abandonment in place of 0.5 miles of existing waterlines, and construction of a 700,000 gallon storage tank. Miscellaneous service taps, tie-ins, isolation valves, and new or replacement fire hydrants would also be constructed.

Location of replacement and additional lines and the new storage tank are shown on figure 2. Replacement of existing waterlines would increase fire-flow capacity and lessen total flows by reducing leakage. Construction of additional waterlines would close loops, improve distribution of fire flows, eliminate use of waterlines in a common trench with sewer lines, eliminate reliance on a single waterline to distribute water from storage to the western portion of the village, and provide a direct hookup between the water supply line and the storage tank farm. Construction of a new storage tank would provide necessary additional storage for fire flows in the upper pressure zone.

Apache Street and Boulder Street Options. There are two options for the alignment of new 6-inch distribution lines to serve these two residential streets:

Option A - The existing 6-inch distribution lines in the front yards of the houses on the north side of Apache and Boulder streets would be replaced with new distribution lines installed in the existing trench. Replacement of the distribution lines would not require blasting. Apache Street service lines are in a common trench with sewer lines; therefore, they would be abandoned and new service lines would be installed. Installation would require blasting and/or hand excavation. Existing Boulder Street service lines would be replaced or connected to the replacement distribution line. Option A would disrupt use of Apache Street during service line installation and would require removal of vegetation (including a number of trees) from front yards.

Option B (Preferred Option) - The existing 6-inch distribution lines would be abandoned and new distribution lines would be installed near the northern edge of Apache Street and Boulder Street. Placement of the new distribution lines would require blasting. New Apache Street service lines would be installed and would require blasting and/or hand excavation. Existing Boulder Street service lines would be replaced or extended and connected to the new distribution line. Extension of these lines would require blasting and/or hand excavation. Option B would disrupt use of Apache and Boulder streets during service line and distribution line installation. It would require less removal of vegetation, including trees from front yards.

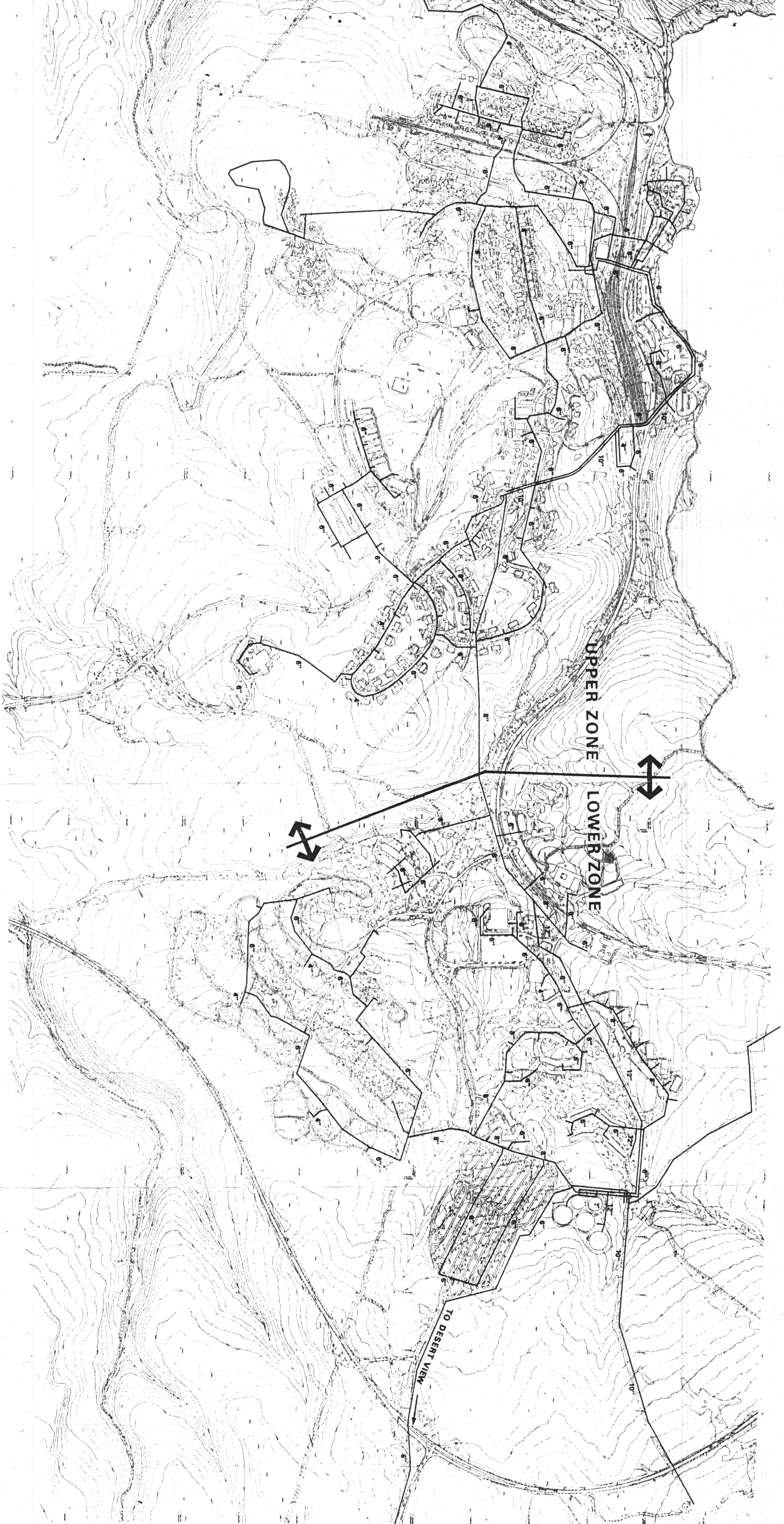
Both options would include revisions in the area of Apache Street: reducing the width of each end of Apache Street and constricting traffic to one-way circulation; curbing Apache Street; allowing only parallel parking in front of residences and prohibiting overnight parking; paving alleys and providing parking areas behind houses on both sides of Apache Street; establishing walkways between the parking areas and the rear entrances of the houses.

The scope and cost of alternative 2 precludes scheduling all work in one year. Therefore, construction is scheduled over a two-year period, beginning in 1985 if environmental compliance clearance is completed and work proceeds as scheduled. Correction of the most critical sections of the water distribution system received priority scheduling. These sections include construction of the additional waterline from storage to the lower pressure zone and replacement of lines in the old village area. These lines are the oldest and most susceptible to breaks and leaks. Scheduling of construction was developed to also minimize traffic interruptions, water shutoffs, and other disruptions to visitor and residential facilities and park operations. As much construction as possible within the old village area would be scheduled during low visitation months. The tentative schedule for the two-year period is listed below:

which are what?

Year 1

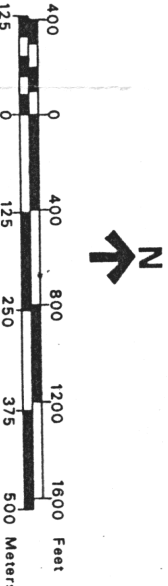
Replace 12,100 feet of 6- to 10-inch pipeline with 6- to 12-inch pipeline



UPPER ZONE

LOWER ZONE

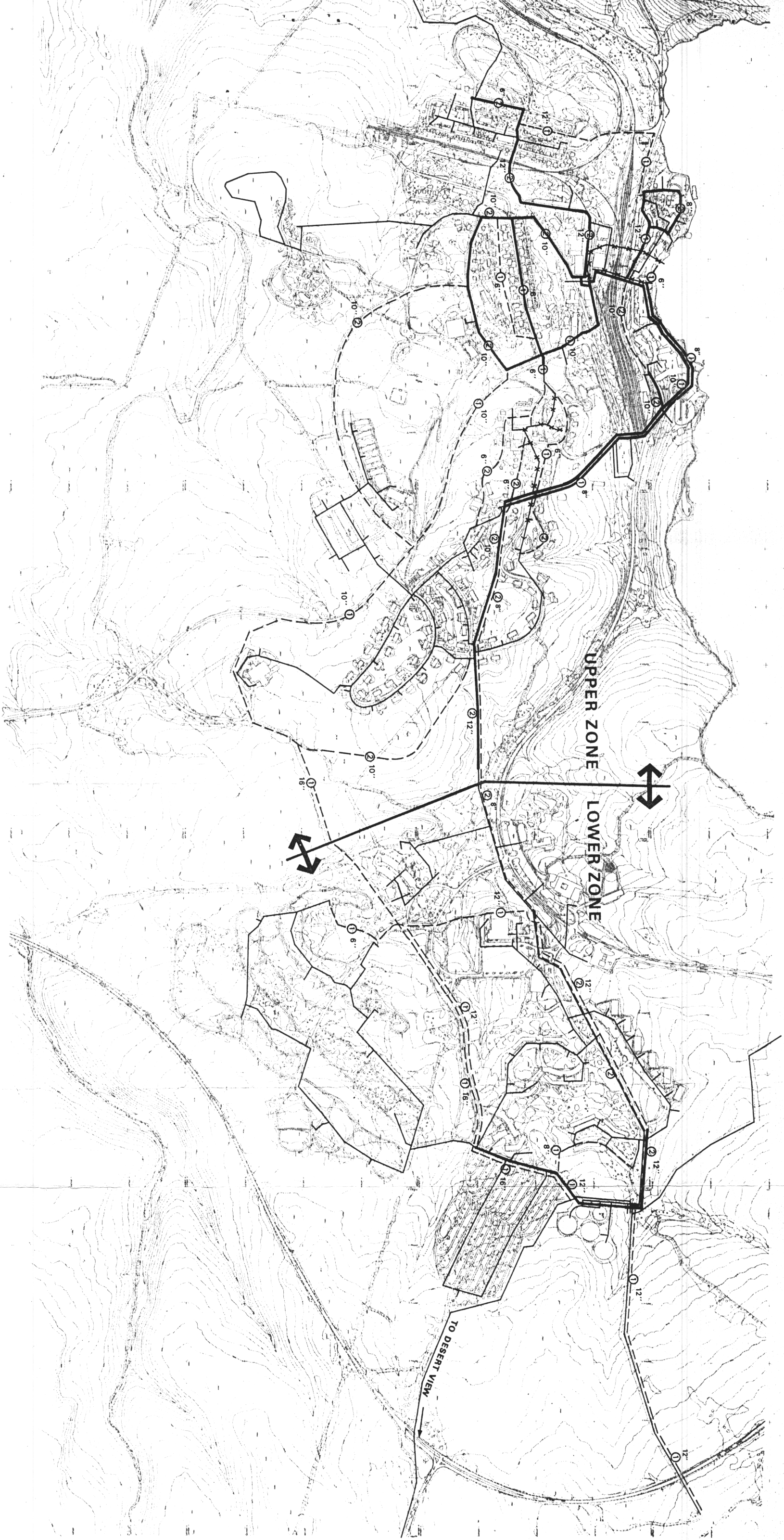
TO DESERT VIEW



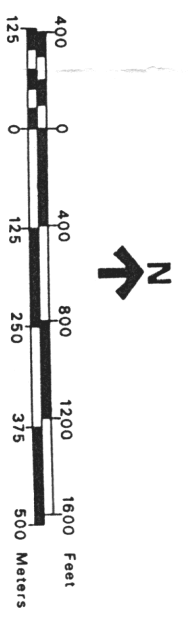
EXISTING CONDITIONS

Water Distribution System

SOUTH RIM VILLAGE
GRAND CANYON NATIONAL PARK
UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE



— EXISTING LINE
— REPLACEMENT LINE
- - - PROPOSED LINE
x x x x x ABANDONED LINE



PROPOSED REPLACEMENTS AND IMPROVEMENTS PROGRAM Water Distribution System

Construct 21,408 feet of 6- to 16-inch pipeline

Abandon 2,900 feet of 6-inch pipeline

Construct a new 400,000-gallon reservoir in upper pressure zone

Year 2

Replace 8,655 feet of 6- to 8-inch pipeline with 6- to 12-inch pipeline

Construct 16,480 feet of 6- to 12-inch pipeline

Necessary permits would be obtained before project implementation.

Sections (approx. 12,000 feet) of new waterlines would be placed under existing paved roadways. This placement would be required when crossing roadways and used when following roadways to provide easier winter access to lines and to preclude disruption of adjacent drainage ditches. The latter case would require the use of one roadway lane and 2 to 3 feet along the shoulder. Acceptable detours or controlled one-lane traffic usage would be provided for all disrupted roadways. Road disruptions in critical areas would be scheduled during low visitation months if possible. These critical areas include the old village area and Center Road.

Disruption to vegetation would be minimized by using previously disturbed road and utility alignments where practical, using rubber-tired vehicles in

all off-road areas, aerating the soil following compaction from construction activities, parking of vehicles in designated areas, fencing rehabilitated sites from foot traffic, and removing no more cover than was necessary for immediate construction. Seeding and planting of disturbed areas with native species would be undertaken where necessary.

DESERT VIEW ALTERNATIVES

Alternative 1 (No-Action) Continue to Haul Water from South Rim Village

The park would continue to haul water by truck to Desert View from the South Rim Village maintenance area. This is a 50-mile, round-trip haul along the East Rim Drive. Currently, the park's 6,000-gallon water truck is in use almost constantly over an eight-hour shift during the summer months. The use of a second and possibly a third water truck would be necessary to meet projected increasing water demands at Desert View.

The number of trips and hours per day that would be required to haul water to Desert View, based on present and projected water demands for both peak season and off season, under full development and limited development are shown in table 1. In the limited development projection and by year 6 for the full development projection one truck would be used for two shifts per day in the summer or a second truck would be put into service to reduce the load on a single truck and to provide standby capacity in case a truck breaks down. By year 11 for the full development projection, a second truck would become mandatory and would be used for two shifts per day or a third truck would be acquired.

Alternative 2 - Haul Water from Loading Station Below Buggeln Hill

The initial 13.7 miles of the existing Desert View waterline, beginning at the village storage tank farm and extending to below Buggeln Hill, would be tested, repaired, and put into service according to the previously mentioned recommendations. This would include rehabilitation of air relief valves, installation of electrical controls, rehabilitation of the existing control system, and construction of a loading station. The park is currently working on these requirements to make the existing line operational.

Water would then be hauled by truck from the Buggeln Hill loading station to Desert View, a 20-mile round-trip. Hauling from Buggeln Hill would proceed for about seven to eight months out of the year, with hauling from the village the remaining four to five months. Use of the waterline would not be year-round because it would be difficult to preventing freezing of only this segment of the line and to keep the loading station open in the winter.

The number of trips and hours per day that would be required to haul water are shown in table 1. Under this alternative the need for a second water truck for standby capacity would be eliminated for the limited development projection and not be required until year 11 for the full development projection.

Alternative 3 - (Preferred Alternative) - Complete Desert View Waterline

A 6-inch waterline would be constructed, using the existing 6-inch waterline to Desert View as a takeoff point and extending to the existing Desert View storage facility. The length of the proposed line would be 6 miles and would follow an existing overhead electric line corridor (see figure 4). All work required under alternative 2 to put the 13.7 miles of the existing waterline into operation, except construction of a loading station, would be required under this alternative. The remaining 2.4 miles of the existing line would be tested and repaired. The existing pumps and proposed completed waterline would be capable of delivering 120 gallons per minute (gpm).

Hauling of water to Desert View would be discontinued with the waterline in operation year-round. Freezing of the line could be prevented by allowing water to flow back through the line from the reservoir when the pump is off.

The proposed waterline would be installed at a minimum depth of 3 feet. Trenching would require blasting. Disruption to vegetation and wildlife habitat would be minimized by using the previously disturbed overhead electric line corridor and by removing no more cover than was necessary for immediate construction. Construction access routes would be limited to existing access routes used during construction and periodic maintenance of the existing electric line.

Cost Comparison

Annual costs and the life-cycle cost for each alternative based on present and projected water demands are shown in appendix B. All costs are presented in 1983 dollars. Complete cost calculations are included in the Engineering Study, Replace Water Distribution System.

Alternative Eliminated from Detailed Study

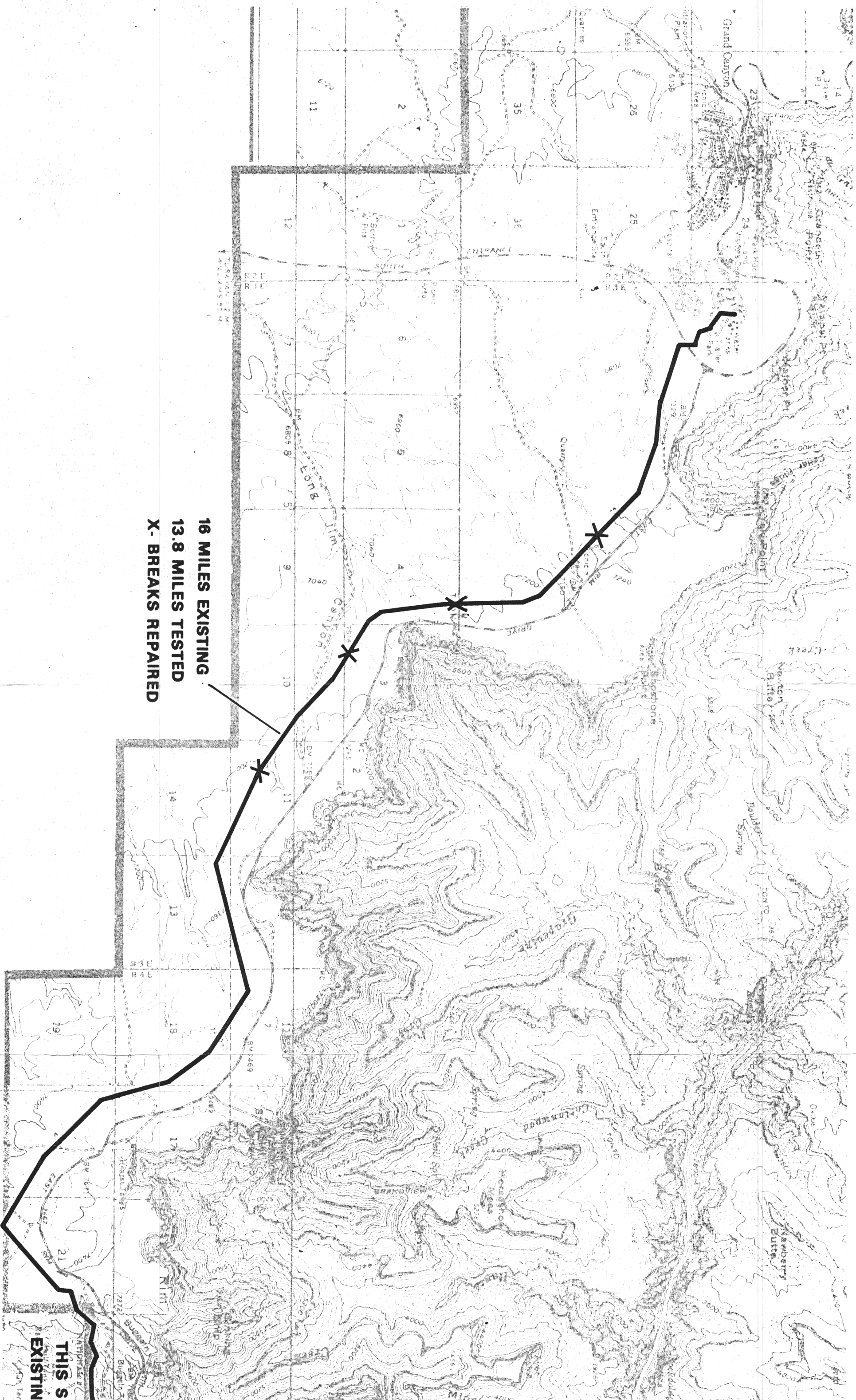
An alternative alignment for the proposed completion of the Desert View waterline adjacent to the East Rim Drive was considered and dismissed. The disadvantages of this alternative as opposed to alternative 3 include the following. This alignment is considerably longer and it would disturb more acreage. It would also result in considerably more impacts during construction due to its proximity to the East Rim Drive. Visitors and park personnel would be subject to traffic interruptions and visual and noise intrusions. This alternative does not provide any advantages over alternative 3 other than greater and easier construction and maintenance access. This is not an appreciable advantage due to adequate existing access routes available under alternative 3.

Table 1: Hours Required to Haul Water to Desert View
for Alternatives 1 and 2
(projections based on 1982 water usage)

Peak Season					
Period	Trips Per Day	Alternative 1		Alternative 2	
		Total Hours Per Day	Road Hours Per Day	Total Hours Per Day	Road Hours Per Day
<u>Full Development</u>					
Years 1 - 5	3	8.0	5.0	5.4	2.4
Years 6 - 10	4	10.7(a)	6.7	7.2	3.2
Years 11 - 25	9	24.0(b)	15.0	16.2(a)	7.2
<u>Limited Development</u>	4	10.7(a)	6.7	7.2	3.2
<u>Off-Season</u>					
<u>Full Development</u>					
Years 1 - 5	1	2.7	1.7	2.7	1.7
Years 6 - 10	2	5.3	3.3	5.3	3.3
Years 11 - 25	4	10.7(a)	6.7	10.7(a)	6.7
<u>Limited Development</u>	2	5.3	3.3	5.3	3.3

NOTES: (a) Two trucks required or one truck used for two shifts per day.

(b) Three trucks required or two trucks with one used for two shifts per day.



16 MILES EXISTING
13.8 MILES TESTED
X - BREAKS REPAIRED

THIS SE
EXISTING

AFFECTED ENVIRONMENT

EXISTING CONDITIONS

Location and Access

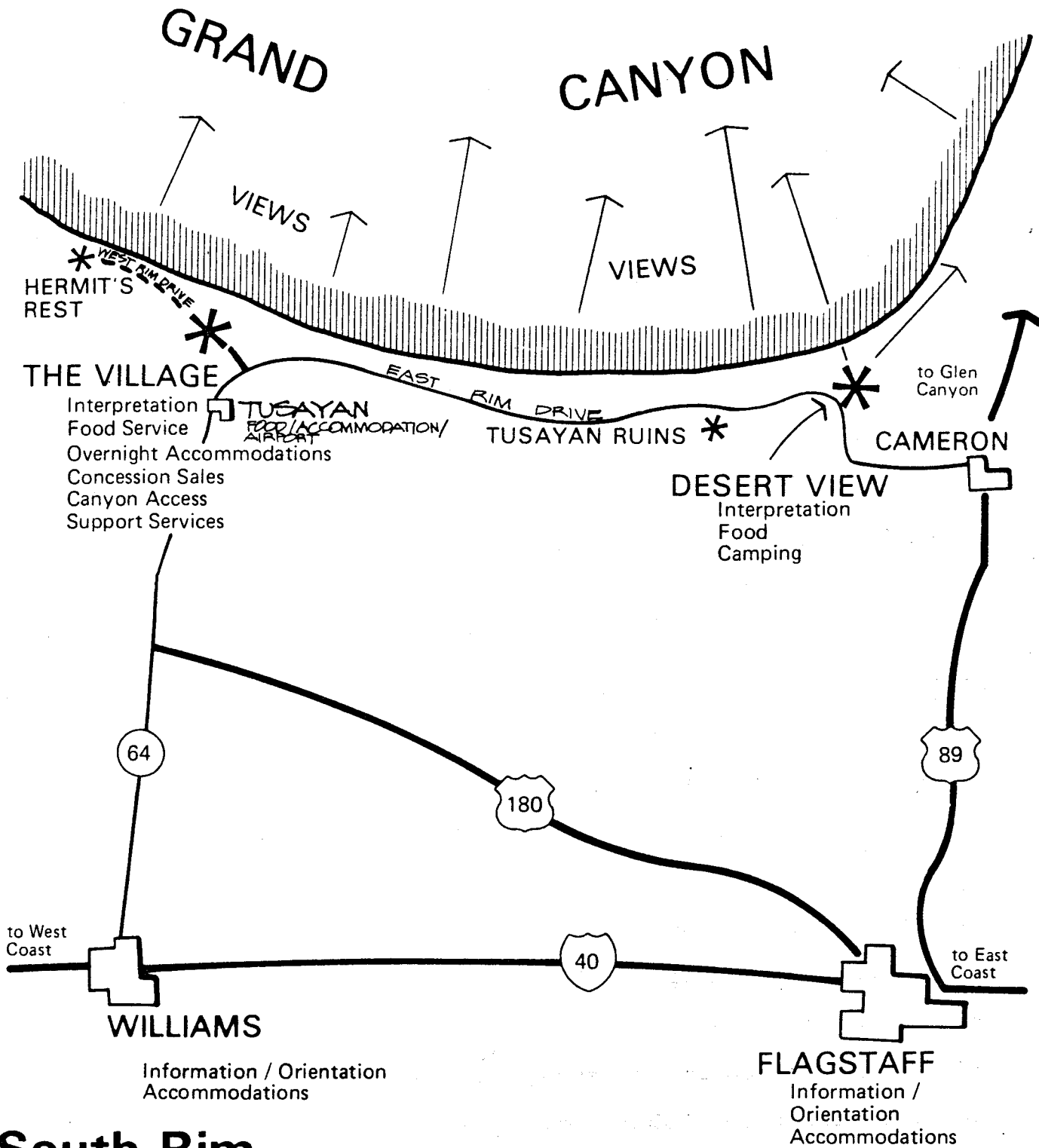
The majority of visitors enter and leave Grand Canyon National Park through the south entrance on Arizona Highway 64/U.S. Highway 180, which joins the East and West Rim drives at the South Rim Village. The West Rim Drive dead-ends at Hermits Rest 8 miles to the west of this junction. Arizona Highway 64 continues east for 22 miles along the East Rim Drive to Desert View before it leaves the park for its junction with U.S. Highway 89 at Cameron (see South Rim map).

Existing Development

The South Rim Village is the largest developed area in the park. It occupies about 3.3 square miles on the South Rim of the Grand Canyon. The majority of park and concessioner services and residential facilities are in the village, and it serves as the park's major overlook and interpretive facility. Overnight visitor accommodations in the village have been limited to present levels as prescribed by the park's General Management Plan and the Development Concept Plan for the village. These accommodations are limited to about 900 hotel/motel rooms and about 550 camping sites.

Desert View is a small visitor complex near the eastern entrance to the South Rim. It consists of an NPS-operated, 50-unit campground; concessioner-operated cafeteria, store, and gas station; NPS/concessioner ^{2 curio stores -} employee housing (10 to 12 trailers and 3 to 4-plex apartment units); and a minor NPS maintenance facility. The facilities at Desert View provide services to visitors entering and leaving the park through the Desert View entrance.

how many



South Rim

Grand Canyon Village
 Grand Canyon National Park



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Water Supply and Distribution System

The existing water supply to the South Rim developments is supplied by a transcanyon pipeline that originates at Roaring Springs on the north side of the Colorado River. The system operates by gravity to the Indian Gardens pumping station below the South Rim. At Indian Gardens water is pumped up to the village and fed directly into the distribution system.

The water distribution system for the village consists of approximately 57 miles of distribution mains (see Existing Conditions map). The system consists of an upper and lower pressure zone.

The lower zone contains the majority of the village west of Mather campground and Mather Center, and the upper zone contains the remaining portion of the village east of and including these facilities. The majority of the oldest waterlines are in the lower pressure zone within the old village area. These lines are 40 to 50 years old. 80?

Water storage in the village currently totals 13.3 million gallons. Five aboveground tanks holding 13 million gallons are in the trailer village area. This tank farm provides storage for the lower pressure zone system. Water is supplied from storage to this zone by a single 8-inch line. One aboveground, 300,000 gallon tank ^{near} at Mather Point provides storage for the upper pressure zone. Water is supplied from storage to this zone by a single 8-inch line.

Sixteen miles of a 6-inch waterline to Desert View from the village tank farm was installed in 1965. This waterline was only operational for one year, during which time the park hauled water from a loading station at Buggeln Hill to Desert View. Use of the line was discontinued due to breaks resulting from poor installation and freezing.

The remaining 6 miles of waterline required to complete the line to Desert View has never been installed. All water for Desert View is currently being hauled from the village maintenance area in a 6,000-gallon NPS tank truck via the East Rim Drive. This is a 50-mile round-trip that averages about 3 hours to complete. An average of three trips per day are made during peak visitation months.

Inspection and testing of 13.7 miles of the existing Desert View waterline were completed in October 1982. That portion of the line was evaluated to be in excellent condition. Three major waterline breaks were located and repaired, and numerous freeze-damaged or otherwise inoperational air relief valves were located and removed. The existing pump was also tested and found to be operational.

Based on this information, it was concluded that the existing pumping equipment and waterline could be restored for use.

Recommendations to make the waterline operational were made by Denver Service Center personnel at that time. These recommendations were overhauling the waterline control valve and air relief valves, retesting in the spring 1983 of the 13.7 miles of line previously tested to locate the

remaining minor 7 gpm in leaks that have not been located, and testing the remaining 2.4 miles of waterline and repairing any breaks.

Existing storage capacity of Desert View is 150,000 gallons. Sewer and water systems are in place at Desert View for proposed expansion of housing, maintenance, and campground facilities. The existing lagoon system is already operating at capacity.

NATURAL ENVIRONMENT

Soils/Topography

Soils along the South Rim are derived from the underlying Kaibab limestone bedrock and a few remnant patches of siltstone. These soils are thin (averaging approximately 6 inches), stoney, poorly developed, very low in organic content, and subject to dessication during the summer. These shallow soils and scattered vegetation allow rapid infiltration of rain and snowmelt into the deep, open joints of the underlying Kaibab limestone. Blasting of bedrock when excavating for utility lines is usually required because of the thin soils, particularly for waterlines that must be below the frost zone.

The landscape within the South Rim Village is predominantly level or has an upslope approach to the rim. A natural bowl is just south of the rim, in which the railroad station and tracks are located. Between the village and Desert View the relief changes to rolling hills with slopes that are commonly 12 to 15 percent.

According to the U.S. Soil Conservation Service, there is no prime farmland in the vicinity of either project. *Not orchards* ?

Vegetation

The projects are in an area of both pure and mixed stands of pinyon and juniper woodland and ponderosa pine forest. Both forest types are open

and dry with much exposed, bare, and rocky ground. Principal species include ponderosa pine (Pinus ponderosa), Colorado pinyon pine (Pinus edulis), Utah juniper (Juniperus osteosperma), and Gambel oak (Quercus gambellii). Height of the overstory vegetation varies from about 20 to 30 feet in many of the pinyon, juniper, and oak stands, to about 50 feet for the oldest ponderosa pines. The ground cover is sparse, consisting principally of scattered grasses, forbs, and low shrubs such as big sagebrush, serviceberry, rabbitbrush, and blue gramma. Domestic grasses are also found within the village, predominantly bordering visitor use areas along the rim. A more detailed listing of plant species can be found in the Final Environmental Impact Statement for the Grand Canyon Complex Master Plan.

Most of the vegetation in the project areas has been affected by human activity to some degree. The alignment for the proposed Desert View waterline extension is within an existing overhead electric line corridor that was cleared of vegetation during construction. Reinvasion by native species, particularly dominant species, has been slow. This corridor of previous disturbance is easily discernible.

Because the forest is open in the village, foot travel is facilitated, which is considerable in areas near residences and visitor use areas. Ground cover is often damaged or destroyed and the soil compacted. Disturbance of native vegetation is widespread in the area of the frame housing units because vehicles park wherever they can be conveniently driven. *Not true*
Roads do not provide adequate, road, any shoulder where vehicles can be parked

No federally listed or proposed threatened or endangered species (Federal Register, May 20, 1980) exist in the vicinity of either project. Informal consultation with the U.S. Fish and Wildlife Service and the Arizona Natural Heritage Program identified three candidate species that may occur in the vicinity of the village. Astragalus cremnophylax (cliff milkvetch) may be found along the South Rim at about 7,000 feet in limestone pavement crevices in pinyon-juniper woodland. Halopappus cervinus (goldenweed) is found in rocky canyons up to 7,500 feet in the pinyon-juniper woodland to pine forest. The preferred habitat of these species does not occur within the areas impacted by either project. Clematis hirsutissima var. arizonica (clematis) is found in the village area and along the South Rim at 7,000 to 8,000 feet in the transition life zone. Park staff would conduct a reconnaissance of the project areas before construction to confirm if this latter species was present to make a determination of impact or no impact. If this reconnaissance should locate this species and determine that it would be adversely impacted by the project, the National Park Service would initiate further consultation with the U.S. Fish and Wildlife Service to identify possible mitigating measures.

Neither project would be located in or adjacent to wetlands as defined in Executive Order 11990. No compliance is required.

Wildlife

Resident birds, particularly Steller's jays, pinyon jays, and ravens are plentiful along the South Rim. At least 40 other species are either seasonally or perennially common. Small mammals that are common include the Abert squirrel, rock squirrel, pocket gopher, deer mouse, house mouse, and pinyon mouse. The only large mammal frequently observed is the mule deer. Others less frequently seen include coyote, gray fox, and bobcat. Overall, the substantial level of development and human activity in the South Rim Village limits its value as wildlife habitat.

There are no known federally listed threatened or endangered species residing in or frequenting either project area.

Water Resources

Both project areas contain several natural watercourses. They generally drain to the south and southwest. Surface streams are more ephemeral than intermittent. Streams are near the beginning of the watershed that originates at the South Rim, water infiltration into the underlying Kaibab limestone is rapid, and the water table is far below the stream courses. Surface flow seldom lasts more than one to two hours after a storm.

These watercourses handle the existing drainage adequately. Flash flooding of the drainages in the Desert View projection area is not a problem. During periods of heavy precipitation, occasional flooding

occurs in the area of the railroad tracks located in the natural bowl.

The park hydrologist reports that flooding occurs on an average of once a year at the village loop drive in front of the superintendent's former residence because of debris-filled culverts probably caused by

park
hydrologist
!!!

misalignment near the Fred Harvey general offices. A heavy thunderstorm (greater than 1.0 inch) will render the drive impassible for

~~a short time.~~ also the road filled in the drainage,

There is no source of freshwater that can be exploited economically in the village area. Water for domestic use and fire suppression needs for all South Rim park and concession facilities is supplied by way of the transcanyon pipeline. The annual water supply potential for the South Rim is estimated at 193 million gallons (Engineering Study 1983). If thunderstorms occur often, or if there are serious maintenance problems, the annual supply figure would be less. The present Indian Gardens pumping capacity (average 420 gpm) is less than the average daily use rate during peak visitation months. Storage tanks provide equalization storage to make up this deficiency, but present storage (13.3 million gallons in the village) is only marginally adequate to meet equalization storage demands and to provide necessary fire and emergency reserves. Storage would be rapidly depleted if a major pipeline break or pump outage were to cause the water supply from Indian Gardens to be cut off during the peak visitation months.

rainfall !!!

Information from 1982 park records shows an annual production figure of 187 million gallons of water entering the distribution system and a total use figure of 133 million gallons, which does not include reclaimed water.

This difference of 53.3 million gallons in what was produced and what was metered indicates the percent of water left unaccounted for, calculated in 1982 at 28.5 percent. In part, this unaccounted water can be explained by nonmetered services such as testing, flushings, and fire protection. However it is estimated that a majority of this loss is due to leakage, conservatively estimating that loss through system leaks in 1982 equaled 30 million gallons per year.

Air Quality

Grand Canyon National Park is classified as a class I air quality area in accordance with the Clean Air Act of 1977. This classification allows the least increase in ambient levels of pollutants.

CULTURAL RESOURCES

Archeological Resources

An archeological survey of the Grand Canyon Village and vicinity was conducted in 1973 by the Museum of Northern Arizona for the National Park Service. Survey crews identified 53 locations of archeological value, dating from an occupation period of 700 to 1000 A.D. Twenty-three of these sites were recorded with permanent site numbers. Since that time, several additional sites have been identified in the village area.

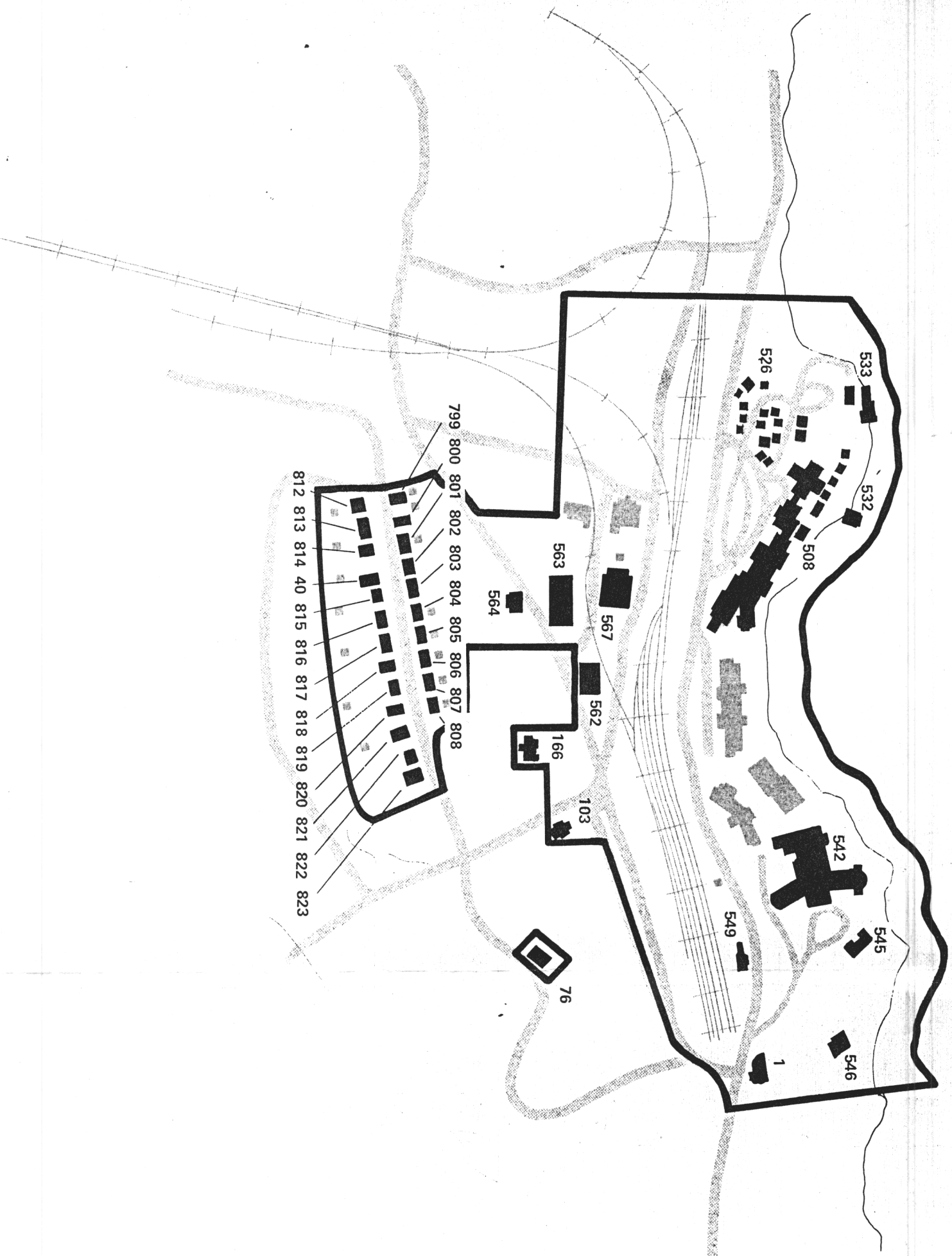
Tusayan Ruins, east of the village near Desert View, is listed on the National Register of Historic Places. This site includes a medium-sized 13th-century Anasazi pueblo and two pithouse structures. While it is the only archeological site within the project area currently on the National Register, all 2,500+ archeological sites within the park are now under consideration by the Arizona State Historic Preservation Officer for eligibility as a multiple resource area.

Historic Resources

The Grand Canyon Village area is rich in historic resources, dating from the first period of tourist and park development. The Grand Canyon Village Historic District, entered on the National Register of Historic Places in 1975 and revised in 1982, contains 61 historic structures dating from the late 1890s to the mid 1930s (see Historic District map). The district is considered to be of regional architectural significance and regional historic significance in the fields of commerce, transportation, and conservation.

There are no other historic properties within the project area on or eligible to the National Register of Historic Places, with the exception of the Desert View watchtower at Desert View. This structure, built in 1932, is considered to be eligible for listing on the National Register but has not yet been nominated.

Grand view?
not true
many
are
eligible,
many were
listed, few
were
omitted



- 533 Kolb Brothers Studio
- 526 Red Horse Stage Station
- 532 Lookout Studio
- 508 Bucky Orrell Cabin
- 542 El Tovar Hotel
- 545 Hopi House
- 546 Verkamp's Canyon Sawmill Shop
- 1 Superintendent's Residence
- 549 Grand Canyon Railroad Depot
- 567 Grand Canyon Power House
- 562 Horse Barn
- 563 Mule Stable
- 564 Blacksmith Shop
- 166 Grand Canyon Post Office
- 103 Park Operations Building
- 76 Ranger's Detachment
- 799-808 Apache Street Residences
- 812-823 Unnumbered - Bright Angel Lodge Complex

NOT TO SCALE



HISTORIC DISTRICT Grand Canyon Village Grand Canyon National Park

UNITED STATES DEPARTMENT OF THE INTERIOR / NATIONAL PARK SERVICE

SOCIOECONOMIC ENVIRONMENT

Visitor Use

Visitation to Grand Canyon National Park in 1982 was approximately 2.5 million. The majority of visitors view the canyon from the South Rim and stay less than one day. Overnight visitation in the park is limited by available accommodations. ^{and campsites,} During the summer use season, all overnight accommodations ^{and campsites,} operate at near capacity.

Visitor activity on the South Rim and in the village is primarily concentrated along the canyon rim. The range of visitor activities is limited by the nature of the resource. ^{??} The primary activities are viewing the canyon, participating in interpretation, and patronizing concession facilities.

how limited?
compared to what?

driving
riding bus
photography
hiking
walking
mule riding

The Region

Adjoining the southern border of the park is the Kaibab National Forest. Scattered throughout the national forest are privately owned lands. The major private property development is the community of Tusayan.

Tusayan lies about one mile south of Grand Canyon National Park along Arizona Highway 64. The community encompasses about 157 acres and has a permanent population of approximately 350 residents. The major source of income and jobs for Tusayan residents are tourist-oriented

services and enterprises. Expansion at Tusayan has been hampered to a great degree by the high cost of potable water and limited private land available for development.

*status
of
Association
"District"*

The primary supply of water for Tusayan is trucked to Tusayan from Williams, Arizona, 50 miles to the south. Grand Canyon National Park also sells water to the Tusayan Water Development Association. The association's district includes Tusayan, the U.S. Forest Service's Ten-X campground, ranger station facilities, and Moqui Lodge; and Grand Canyon National Park Airport (subsequent references to Tusayan will infer this to include the entire water association district). The delivered charge for water in 1982 was \$25 per 1,000 gallons, regardless of the supply source. The highest water usage months tend to occur from late spring through early fall. Annual water needs are approximately 30 to 32 million gallons per year according to figures provided by the Tusayan Water Development Association.

In 1978 Congress passed PL 95-586 which uniquely allows for the sale of water from Grand Canyon National Park to Tusayan, Arizona, provided that "determination that such sale is not detrimental to the protection of the resources of Grand Canyon National Park or its visitors and that appropriate measures to provide for such protection, including a right of immediate termination are included in the transaction." Accordingly, a memorandum of agreement between Grand Canyon National Park and the Tusayan Water Development Association dated December 1980 has been made for the sale of water. The Park Service is currently conducting a scientific study to determine if this sale of water is detrimental to the

resources. Water is available for sale only during those periods when all Park Service requirements have been met and additional water is available.

During peak visitation months the park cannot pump enough water from Indian Gardens to meet park demands; therefore, during these periods the park draws on storage to help meet demands. When water storage levels are not maintained at a level necessary to provide for domestic use, fire protection, and emergencies reserves, no water is sold to Tusayan. As a result water is sold to Tusayan during the period from fall (only after all storage tanks in the park have been refilled) to spring. A variety of variables (number of visitors, visitation patterns, seasonality of visitation, pump breakdowns, and storm caused down time have a significant influence on the water requirements within the park, and in turn, on the availability of water for sale to Tusayan.

Subsequent to the passage of PL 95-586, Grand Canyon National Park has sold water in quantities which are approximately 60 to 70 percent of Tusayan's water needs during those periods when water has been available for sale. The following figures indicate the amount of water purchased by Tusayan from the park and from nonpark sources for the same time periods:

	<u>Water Purchased from the Park</u> (million gallons)	<u>Water Purchased from Nonpark Sources</u> (million gallons)
December 1980 - March 1981	5.0	3.2
December 1981 - May 1982	8.3	3.4

?
0
Or is this Water Assn - two
are not equivalent?

ENVIRONMENTAL CONSEQUENCES

NATURAL ENVIRONMENT

Soils/Topography

General Impacts. Temporary disturbance of soils would occur in areas of construction due to movement of heavy machinery and excavation work. Areas cleared and leveled for construction of permanent structures, such as the storage tank, would be permanently lost to construction.

Removal of ground cover and compaction of soils would temporarily decrease soil permeability, locally alter soil moisture and temperature, and increase surface runoff and erosion. Exposure of soils would also temporarily increase their susceptibility to wind erosion. Impacted soils would gradually recover to former levels of moisture and bulk following construction.

Overall, impacts to soils would not be significant. Existing soils are moderately to severely impacted by existing facilities and human activity. Erosion would be minimal because of predominantly flat topography and the soils rapid drainage capacity. The majority of construction would take advantage of previously disturbed areas along roadways and existing utility lines.

South Rim Village Alternatives. Under alternative 1 there would be no new impacts beyond those that occur due to routine maintenance operations. Alternative 2 would disrupt approximately 35 acres of predominantly previously and continually disturbed soils.

Desert View Alternatives. Under alternative 1 there would be no new impacts. Alternative 2 would result in only minimal disruption of soils for construction of a loading station and rehabilitation of the existing waterline. Alternative 3 would disturb approximately 1.5 acres more land than alternative 2 along the electric line corridor for extension of the waterline.

Vegetation

Excavation and associated construction activity would remove or crush vegetation in areas that would later revegetate. Construction of impervious structures would permanently preclude vegetation. Affected vegetation would primarily be understory species. Any trees within construction limits would be removed and those bordering the limits might be adversely affected due to disturbance of root systems and inadvertent scarring.

Revegetation of land following disturbance is slow and scars might be perpetuated for years. Initial invasion would be by exotic grasses and later by native species until reaching patterns of diversity and frequency in keeping with topographic and climatic conditions and the degree of

??
50-100
years!

continuing human use. Areas that would be seeded/planted would prevent invasion by exotics.

Disturbance to natural terrain would be minimized by limiting construction to the smallest area possible. Also, construction would primarily take place along existing roadways and previously cleared utility cuts. This would reduce removal of overstory vegetation (ponderosa pines, pinyon pines, and junipers) that has slow growth rates and is useful in landscaping as an aesthetic screen.

The acreage of vegetation disturbed would be similar to acreage discussed under soil impacts.

Growth rate?
Seeding with native species and mulching of select areas disturbed by construction would be undertaken to reduce the adverse impact of trenching scars, as well as reduce blowing dust and erosion. A field reconnaissance for the candidate plant species, clematis hirsutissima var. arizonica, would occur prior to construction. No effect on endangered or threatened plant species is anticipated.

Option A. Placement of the 6-inch distribution lines would require the removal of a substantial number of trees within 300- and 400-foot swaths along the front yards of residences on Apache Street and Boulder Street. The following number of trees would possibly be removed or damaged by construction along each street: Apache Street - 2 ponderosa pines, 7 junipers, and 26 pinyon pines (almost all are mature trees); Boulder Street - 2 ponderosa pines, 25 junipers, and 54 pinyon pines. The

majority of the pinyons are saplings 3 to 4 inches in diameter and 6 to 10 feet in height. A few trees may also be removed for placement of 2-inch service lines but removal would be avoided where possible. Trees along these residential streets are aesthetically valuable and serve as shade and screening for the houses.

Option B. Placement of 6-inch distribution lines under Apache Street and Boulder Street would avoid removal of any trees. Placement of 2-inch service lines may require the removal of a few trees as described under Option A.

Wildlife

No significant impacts on wildlife would occur under any of the alternatives. Small mammals or bird species inhabiting construction areas might be disturbed or displaced by construction activities. Acreage of wildlife habitat disturbed would correspond with the acreage calculated under soils impacts for each alternative. There would be no impacts on unusual sensitive or significant wildlife habitat. As no endangered or threatened wildlife species frequent the area, none of the alternatives would have an effect to endangered or threatened species.

Water Resources

General Impacts. There would be no long-term impacts due to construction activities on any of the local watercourses. Minor short-term

disruptions would occur during pipeline placement. There would be no impacts on floodplains, and therefore a Statement of Findings (EO 11988) will not be prepared.

South Rim Village Alternatives. Under alternative 1 there would be no new impacts. The rate of unaccounted water would be expected to increase. Under alternative 2 it is assumed that rehabilitation of the village water system would greatly reduce the amount of unaccounted water. It has been conservatively estimated that a rate of unaccounted water of 2.5 million gallons per month or 30 million gallons per year would be obtainable.

Desert View Alternatives. No new impacts would occur under alternative 1. Water consumption rates would be expected to remain lower than areas, such as the village, where water is more readily available. Alternative 2 would result in an additional demand for water of about 1.16 million gallons per year due to line leakage. Under alternative 3 it is expected that water consumption would increase over present use by a factor of about 1.5 due to piping of water directly to Desert View, as well as line leakage of about 1.63 million gallons per year. See appendix A for a comparison of projected water demand for the three alternatives.

Air Quality

No significant impacts on air quality would occur under any of the alternatives for either proposal. There would be a minor short-term

reduction in air quality in the vicinity of construction due to such pollutants as dust and fumes.

CULTURAL ENVIRONMENT

South Rim Village Alternatives

Alternative 1 (no action) would not create new impacts to archeological or historic resources.

Alternative 2 (including options A and B) is not expected to impact any known archeological sites within the village area. All attempts would be made during final design to avoid known archeological sites. An archeological survey would be conducted and a clearance obtained prior to construction.

Alternative 2 would create minor impacts on a portion of the Bright Angel Lodge complex, which is included in the Grand Canyon Village Historic District. Several cabin units of that complex were built near and directly on top of the original water distribution lines. To replace those lines, it may be necessary to remove portions of the covered walkway connecting some of the cabins and possibly portions of a porch structure. Although those items would be replaced following construction, this would create a "no adverse effect" upon the complex. The National Park Service would consider all feasible design and engineering alternatives to avoid this impact to the structures. If the impact proved to be unavoidable, the

National Park Service would make a formal determination of effect and would seek the concurrence of the Arizona state historic preservation officer and the Advisory Council on Historic Preservation, in accordance with section 106 of the National Historic Preservation Act and the procedures of 36 CFR Part 800, "Protection of Historic and Cultural Properties."

There are no other known impacts to the historic resources of the Grand Canyon Village Historic District. However, since construction would be taking place within the boundaries of a National Register district, appropriate cultural resource compliance procedures would be completed prior to construction, in accordance with NPS-28, "Cultural Resource Management Guidelines."

Desert View Alternatives

Alternative 1 (no action) would create no new impacts to archeological or historic resources.

Alternative 2 would have no impacts upon historic resources or upon known archeological resources. A site-specific archeological survey would be conducted and an archeological clearance obtained, prior to construction of the loading station.

Alternative 3 would have no impacts upon historic resources or upon known archeological resources. A site-specific archeological survey would

be conducted and an archeological clearance obtained, prior to construction of new waterlines and associated development.

SOCIOECONOMIC ENVIRONMENT

Visitors and Residents

South Rim Village - Alternative 1. Those sections of the water distribution system in a common trench with sewer lines would remain and would present a potential health hazard for water consumers. An additional safety hazard would also exist from lack of adequate fire storage and fire-flow capacity.

South Rim Village - Alternative 2. Visitors and residents might be adversely affected by movement of heavy equipment, noise, dust, and fumes, during construction. Restricted traffic flow or detours during construction of sections of waterlines under or adjacent to roadways would be necessary. As much work as possible that would disrupt major visitor traffic routes would be scheduled during the off season. Some individuals would also be inconvenienced due to temporary disruption of pedestrian and bicycle paths. ??

define?

Trenching operations would result in topographical scarring. Visual impacts would be minimal. The village is currently impacted from human activity and development. Scars would be least intrusive where they follow existing roadways and utility cuts, thus minimizing the amount

of ground cover and trees removed. Seeding or planting with native species in selective areas for screening purposes would be undertaken.

Visitors and residents would both benefit from improved health and safety conditions due to correction of water and sewer lines in a common trench and increased fire storage and fire-flow capacity.

Option A. A number of trees would be removed from the front yards of residences on Apache Street and Boulder Street. Ground cover in this area has been highly impacted; however, the trees along these streets are aesthetically valuable and serve as shade and screening for the houses. Impacts created from tree removal would be long term in nature due to the slow growth rate of these species.

Option B. Tree removal and thus impacts to residents from shade and screen loss would be minimized. Short-term impacts due to construction disruption of the streets would be greater; however, long-term disturbance to vegetation and aesthetics would be minimal.

Both options would enhance pedestrian activity in front of Apache Street houses by restricting use of vehicles in this area. Residents would also benefit from provision of parking behind the buildings and elimination of parking in front yards.

Desert View Alternatives. There would be no significant adverse impacts to visitors from ongoing construction due to distance from major visitor use areas. There may be occasional use of the East Rim Drive by

construction vehicles during the project. Alternatives 1 and 2 would require the continued and increasing presence of water trucks traveling this road on a daily basis. During the peak season, alternative 2 would require approximately half as many hours on the road per day and then only between Buggeln Hill and Desert View.

The water trucks would be among the largest and possibly the slowest vehicles on the road. They would hinder traffic and increase air and noise pollution. These adverse impacts would increase as Desert View water demand increased, resulting in a greater number of hauling trips. All of these impacts could adversely affect the visitor experience; however, there is already a certain degree of congestion, air pollution, and noise and visual intrusions along this road due to existing traffic volumes that include numerous buses, campers, and RVs. Whether the presence of water trucks would result in a perceptible degradation of the visitor experience beyond that of other traffic is not known. However, it would appear that there would not be a substantial alteration of those conditions that would exist whether or not the water trucks were present.

Why would
DV water
demands
increase?

To date there have been no major accidents or injuries due to water hauling operations to Desert View. The potential for an accident involving one of the water trucks would increase as the number of haul trips and traffic volumes increased. Due to the damage that could be inflicted by a vehicle the size of a water truck, an increase in the number of haul trips would also increase the potential of an accident (if and when one would occur) involving serious or possibly fatal injuries. In light of these potentially serious consequences, risk management is

What about
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hauling?

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involved in determining what increase in accident probability is acceptable.

It should be noted that hauling during peak visitation season and the associated visitor impacts during that time could be reduced or eliminated if additional storage facilities were constructed at Desert View. Water could be hauled during the off-season and stored at Desert View to supply peak season use. However, this would require more hauling trips under the more hazardous driving conditions in the winter months.

Park Operations and Management

South Rim Village Alternatives. Under alternative 1, operation and maintenance requirements would be expected to increase as unresolved problems with the existing distribution system continued and worsened with further deterioration. Sections of the existing water distribution system is in violation of the Arizona State Department of Health and U.S. Public Health Service regulations due to insufficient separation of water and sewer lines. This situation would threaten the safety of visitors and residents and could result in a decision by the park or the regulatory agencies to discontinue use of those sections of the system. Alternative 2 would resolve these problems of the distribution system, resulting in more efficient and reliable operations.

Desert View Alternatives. All the alternatives would have steadily increasing annual operating costs. These costs would be lowest by far

for alternative 3 and would be comparable for alternatives 1 and 2 until water demand increases above current levels, at which time alternative 2 would result in substantially less cost than alternative 1 (see appendix B). For the limited development projection total annual operating costs would be \$52,425 for alternative 1, \$39,270 for alternative 2, and \$13,610 for alternative 3. In years 11 through 25 for the full development projection total annual operating costs would be \$98,850 for alternative 1, \$73,370 for alternative 2, and \$19,290 for alternative 3.

Comparing the total life-cycle costs, alternative 2 would have the lowest cost, with alternative 3 substantially costlier than either of the water hauling alternatives.

Expansion of park water hauling capabilities would be required under alternatives 1 and 2. Truck operating times and road times would be substantially less under the latter alternative during peak season. Under alternative 1 two trucks would be required for the limited development projection and three trucks would be required for the full development projection. Under alternative 2 one truck would be required for limited development projection and 2 trucks would be required for the full development projection.

Regional Development

South Rim Village Alternatives. Alternative 1 would not result in any changes to those conditions that currently affect the amount of water

available for sale to Tusayan. It would be expected that off-season sale would continue, regulated primarily by such variables as number of visitors, visitation patterns, pumping capacity, and downtime of pumps due to breakdowns, and storms.

Under alternative 2 it is conservatively estimated that a reduction in park water demands of approximately 2.5 million gallons per month could be realized. Flow meters would be put on pipes into the storage tank system to monitor water use. The sale of water to Tusayan would be affected by the variables mentioned above. South Rim water consumption is currently at the estimated reliable water supply potential for the existing Indian Gardens pumping system. Even with the water savings that would result from this alternative, water supply would still fall below water demand during peak season, thus requiring use of equalization storage. During this time water would not be sold to Tusayan. Reducing loss of water due to distribution system leakage would provide a temporary respite until a more long-term solution to the park supply-demand problem could be implemented.

Potentially, in the short-term the park could supply all of Tusayan's water needs during the off season when water is available for sale and possibly extend the period during which water is sold. However this sale highly depends on the other variables affecting park water usage. Water for sale primarily, if not exclusively, during the off season would limit or preclude its support of further development of tourist-related operations at Tusayan unless the storage and hauling capacities are greatly expanded to store water in the off season. In contemplating such an

expansion, reduction of water system loss would be only a small component of total water demand at the South Rim, which would need to be taken into consideration.

Desert View Alternatives. Projected water demand at Desert View would increase under all alternatives (see appendix A). Water demand under alternative 3 would differ substantially from the other two alternatives, reflecting the expected increase in demand when water was piped directly to the area. The greater the water demand from park sources, the less the potential water available for sale to Tusayan. However, the water demand at Desert View under any of the alternatives would be slight (3 to 6 percent by the year 11 and beyond) when compared to the total water demand from all South Rim development. It is this total water demand in conjunction with supply capability that governs the availability of water that is sold to Tusayan. Thus, the potential effect on availability of water such as to support further development in Tusayan due to the implementation of any of the alternatives would not be significant.

Neither the South Rim Village proposal nor the Desert View proposal are expected to singularly or in combination have a significant impact on Tusayan. However, their effects on the total park water demands would be integrated into the evaluation of the alternatives under the National Park Service proposal to improve the Indian Gardens supply capability, Package 174.

Summary of Major Impacts South Rim Village Alternatives

<u>Impacts On</u>	<u>Alternative 1 - No Action</u>	<u>Alternative 2 - Improve the Water Distribtuion System</u>
Soils	No impact	<p>35 acres of primarily previously disrupted soils would be disturbed. Potential for erosion would be minimal.</p> <p>Option A would result in minor (less than 0.5 acres) disturbance to soils.</p> <p>Option B would result in minor (Less than 0.5 acre) disturbance to soils.</p>
Vegetation	No impact	<p>35 acres of vegetation would be removed from primarily previously disturbed road and utility corridors. Vegetation removed would primarily be understory species. Select areas would be seeded or planted with native species.</p> <p>Option A would remove approximately 62 mature trees and 54 saplings, including ponderosa pines, pinyon pines, and junipers.</p> <p>Option B would remove a few trees.</p>
Wildlife	No impact	<p>35 acres of land of limited value as wildlife habitat would be disturbed.</p>
Water Resources	No impact on water-courses. The rate of unaccounted water would increase over the present estimated 54 million gallons per year.	<p>Minor short-term disturbance to watercourses would occur. No impacts on floodplains. The rate of unaccounted water would decrease to an estimated 30 million gallons per year.</p>
Air Quality	No impact	<p>Minor short-term reduction in air quality would occur.</p>

<u>Impacts On</u>	<u>Alternative 1 - No Action</u>	<u>Alternative 2 - Improve the Water Distribtuion System</u>
Cultural Resources	No impact	No impact to known archeological resources. An archeological clearance would be obtained prior to construction. No potential adverse effect on a portion of the Bright Angel Lodge complex.
Visitor and Residents	Water and sewer lines in in common trench would pose a potential health hazard. Lack of adequate fire storage and fire flow capacity would pose a safety hazard.	<p>Improved health and safety conditions would result from correction of water and sewage lines in common trench and increased fire storage and fire flow capacity. Construction activities would result in short-term intrusions on the visitor experience. Visual impacts from trenching operations would be minor and select areas seeded and planted for screening purposes.</p> <p>Option A would result in long-term adverse aesthetic impacts because of removal of trees that are aesthetically valuable and serve as shade and screening for the houses.</p> <p>Option B would result in minor impacts to aesthetics. Construction activities would result in short-term disruption to streets.</p> <p>Both options would enhance pedestrian activity along Apache Street. Residents would benefit from additional parking behind buildings.</p>
Park Operations and Management	Unresolved problems with the water distribution system would continue and worsen with further deterioration. The potential hazard posed by insufficient seperation of water and sewer lines would persist, threatening the safety of visitors and residents, and could result in a decision by the	Improvement of the water distribution system would result in more efficient and reliable operations.

<u>Impacts On</u>	<u>Alternative 1 - No Action</u>	<u>Alternative 2 - Improve the Water Distribution System</u>
Regional Development	park or the regulatory agencies to discontinue use of those sections of the system.	No impact.

Summary of Major Impacts
Desert View Alternatives

		Alternative 2 - Haul Water from Loading Station Below Buggeln Hill	Alternative 3 - Complete Desert View Water Line
Impacts On	Alternative 1 - No Action		
Soils	No impacts	Minor (less than 0.5 acre) disturbance to soils would occur.	1.5 acres of previously dis- rupted soils would be dis- turbed. Potential for erosion would be minimal.
Vegetation	No impact	Minor (less than 0.5 acre) removal of vegetation would occur.	1.5 acres of primarily under- story vegetation would be removed along a previously disturbed utility corridor.
Wildlife	No impact	Minor (less than 0.5 acre) amount of wildlife habitat would be disturbed.	1.5 acres of wildlife habitat would be disturbed.
Water Resources	No impact	Minor short-term disturbance of drainages would occur. No impacts on floodplains. An additional demand for water of about 1.16 million gallons per year would occur due to line leakage.	Minor short-term disturbance of drainages would occur. No impacts on floodplains. An additional demand for water of about 1.63 million gallon per year would occur due to line leakage. Also water demand would increase over present use by a factor of 1.5 due to piping of water directly to Desert View.
Air Quality	No impact	Minor short-term reduction in air quality would occur.	Minor short-term reduction in air quality would occur.
Cultural Resources	No impact	No impact on historic resources or known arche- ological sites would occur. An archeological clearance would be obtained prior to construction.	No impact on historic resources or known archeological sites would occur. An archeological clearance would be obtained prior to construction.
Visitors and Residents	The continued and in- creasing presence of water hauling trucks graveling the East Rim Drive on a daily basis would occur. These trucks would to some degree hinder traffic and increase air and noise pollution. The potential of an accident involving serious injuries would increase as the number of haul trips increases.	The continued and increasing presence of water hauling trucks traveling the East Rim Drive on a daily basis would occur. During the peak season, approximately half as many hours on the road per day and half as many road miles per day would be required compared to alter- native 1. The potential of an accident involving serious injuries would be less than under alternative 1.	Hauling of water to Desert View would be discontinued. The visitor experience and safety would no longer be impacted by the presence of water hauling trucks travel- ing the East Rim Drive to and from Desert View.
Park Operations and Management	Expansion of water haul- ing capabilities would be greater than for alter- native 2. Annual operating costs - Years 11-25 for the full development flow projection: \$98,850 - For the limited develop- ment flow projection: \$52,425	Expansion of water hauling capabilities would be less than for alternative 1. Annual operating costs - Years 11-25 for the full development flow projection: \$73,370 - For the limited development flow projection: \$39,270	Water hauling to Desert View would be discontinued. Annual operating costs - Years 11-25 for the full development flow projection: \$19,290 - For the limited development flow projection: \$13,610
Regional Development	No impact	No impact	No impact

APPENDIX A: PRESENT AND PROJECTED
DESERT VIEW WATER REQUIREMENTS

The fact that all water is hauled to Desert View seems to have placed an effective limitation to water usage at the area. While water usage at Grand Canyon Village has almost doubled in the past ten years, water usage at Desert View has decreased from 3.41 million gallons per year in 1972 to 2.36 million gallons per year in 1982. Estimates of water consumption at areas where water is more readily available are about 1.8 times higher than the maximum consumption rates being experienced at Desert View.

The 1976 Final Master Plan for Grand Canyon National Park calls for an expansion of the campground and visitor support facilities at Desert View. Future flow projections were made based on two assumed levels of development. The first, "full development," flow projection is based on one of the alternatives in the Comprehensive Design/Developed Area Plan being prepared by the Park Service's Western Regional Office. This development alternative proposes an approximate doubling of visitor parking and employee residential facilities, tripling of campground facilities, and the addition of a visitor picnic area. An analysis of this level of development indicates that water usage could increase by a factor of 3 when this expansion of facilities is fully developed. For future flow projections used in the life-cycle cost analysis, it was assumed that the development expansion would occur over a period of about 10 years with 50 percent implementation occurring in five years and 100 percent implementation occurring in 10 years.

The second, "limited development," flow projection assumes that future expansion of facilities will be limited to an amount that would increase overall water demand by 50% or 15 times the current usage.

Water demand was also considered to be effected by the method of water supply to the area as well as the level of facility development. The two factors considered which are related to method of water supply are pipeline leakage and change in demand when water is made more or less readily available. Regardless of which level of development being considered, an additional demand for water could be expected if all or part of the Desert View waterline were placed into service. This would be leakage through pipe joints and valves along the line. This leakage is estimated at 55,000 gallons/mile/year for the Desert View line, which corresponds to a leakage rate of 0.10 gallons per minute/mile.

Water usage in the Desert View development is significantly lower than what would normally be expected at an area where water is readily available. Based on current water usage, consumption is about 1.8 times lower than for more normal areas. It could therefore be expected that water consumption would increase if water was piped directly to the area. A multiplier was required to indicate the difference that could be expected between consumption of hauled water and consumption of pumped water. The 1.8 multiplier discussed above was felt to be excessive, especially if good water conservation procedures were practiced. It was felt that a multiplier of 1.5 would give an appropriate comparison between hauling water and pumping water for the analysis of alternatives. Both the full development and limited development flow projections were

multiplied by this factor for the case where water is pumped directly to Desert View.

Based on assumptions derived from the analysis of water usage, facility expansion, and line leakage, yearly flow requirements were developed for each of the alternatives for water supply to Desert View. Estimated water requirements for the three alternatives are shown in the following table. These yearly flows were then used to perform a life-cycle cost analysis on the three alternatives (appendix B).

Present and Predicted Future Water Demand at Desert View
(flows in million gallons/year)

*based on
what?*

Alternative		Full Development			Limited Development
		Years 1 thru 5	Years 6 thru 10(b)	Years 11 and Beyond(c)	Year 1 and Beyond(d)
1. Haul from village	User demand	2.36	3.54	7.08	3.54
	Line leakage	0	0	0	0
	Total demand	2.36	3.54	7.08	3.54
2. Haul from Buggeln Area	User demand	2.36	3.54	7.08	3.54
	Line leakage (a)	0.47	0.47	0.47	0.47
	Total demand	2.83	4.01	7.55	4.01
3. Pump directly to Desert View (d)	User demand	3.54	5.31	10.62	5.31
	Line leakage (a)	1.20	1.20	1.20	1.20
	Total demand	4.74	6.51	11.82	6.51

(a) Line leakage estimated at 50,000 gal/yr/mile of line

(b) Flow for years 6 thru 10 = present flow x 1.5

(c) Full development flow for years 11 and beyond = present flow x 3.0

(d) Limited development flow for year 1 and beyond = present flow x 1.5.

(e) Demand is assumed to increase by factor of 1.5 when water becomes available by pipeline

APPENDIX B: SUMMARY OF LIFE-CYCLE COST ANALYSIS

DESERT VIEW WATERLINE

	Alternative 1 <u>Haul from Village</u>	Alternative 2 <u>Haul from Buggeln</u>	Alternative 3 <u>Pump Directly to Desert View</u>
Initial Costs	\$ 0	\$ 12,000	\$1,540,000
<u>Full Development Flow Projection</u>			
Replacement Costs	0	10,000	10,000
Annual O&M Costs			
Years 1 - 5	26,960	23,590	6,000
Years 6 - 10	43,435	30,510	6,000
Years 11 - 25	80,870	57,270	6,000
Annual Fuel Costs			
Years 1 - 5	3,940	2,370	0
Years 6 - 10	5,910	3,550	0
Years 11 - 25	11,820	7,100	0
Annual Electric Power Costs			
Years 1 - 5	2,050	3,950	5,710
Years 6 - 10	3,080	5,210	7,610
Years 11 - 25	6,160	9,000	13,290
Total Life-Cycle Costs (Present Worth)	\$822,000	\$645,000	\$1,583,000
<u>Limited Development Flow Projection</u>			
Initial Costs	\$ 0	\$ 12,000	\$1,540,000
Replacement Costs	0	10,000	10,000
Annual O&M Costs	43,435	30,510	6,000
Annual Fuel Costs	5,910	3,550	0
Annual Electric Power Costs	3,080	5,210	7,610
Total Life-Cycle Costs	\$654,000	\$495,000	\$1,557,000

APPENDIX C: FINDING OF NO SIGNIFICANT IMPACT

FINDING OF NO SIGNIFICANT IMPACT GRAND CANYON NATIONAL PARK REPLACE WATER DISTRIBUTION SYSTEM, VILLAGE AREA

PROPOSED ACTION

The National Park Service proposes to improve the South Rim Village potable water distribution system and to complete the waterline to Desert View.

The purpose of improving the Village water distribution system is to reduce maintenance costs, reduce water leakage, provide adequate capacity for fire flows and domestic demand, improve water flow, provide adequate water storage for fire flows, reduce silt and sedimentation in the distribution system, and eliminate potential health hazards from insufficient separation of water and sewer lines.

The purpose of completing the waterline to Desert View is to improve the water supply operation to Desert View in terms of convenience, annual expenses, and elimination of hauling water by truck to Desert View.

A complete description of the proposal is included in the attached environmental assessment.

WHY THE PROPOSED ACTION WILL NOT HAVE A SIGNIFICANT EFFECT ON THE HUMAN ENVIRONMENT

There will be approximately 37 acres of soil and vegetation disturbed as a result of this project. The majority of construction will occur in previously disturbed areas along utility corridors and roadways. There will be minor visitor inconvenience, soil erosion, dust, and fumes.

Construction of waterlines will result in minor short-term disturbance of drainages, but there will be no adverse or indirect affect on floodplain values.

There will be no impacts to any threatened or endangered species. A survey for clematis hirsutissima var. arizonica, a candidate plant species, will be conducted prior to construction.

The project will have no effect upon the National Register structures in the Village. An archeological survey will be conducted and a clearance obtained prior to construction.

PUBLIC REVIEW AND AVAILABILITY

It was determined that this project will not create any serious environmental consequences nor invaluse any controversial issues.

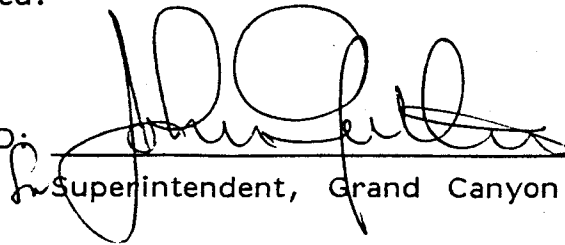
This Finding of No Significant Impact has been incorporated as part of the environmental assessment document. Copies are available from the Superintendent of Grand Canyon National Park and the Regional Director, Western Region, San Francisco, California for any person who is interested.

DETERMINATION

On the basis of the information contained in the environmental assessment as summarized above, it is the determination of the National Park Service that the proposed project is not a major Federal action significantly affecting the quality of the human environment. Nor is the proposed action without precedent or similar to one which normally requires an environmental impact statement. Therefore, in compliance with the

National Environmental Policy Act, an environmental impact statement will not be proposed.

RECOMMENDED:

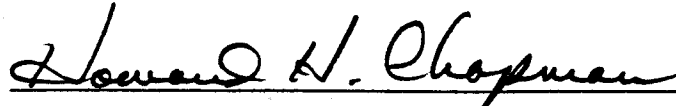


Superintendent, Grand Canyon National Park

4/6/84

Date

APPROVED:



Regional Director, Western Region

4/27/84

Date

REFERENCES

CH₂M HILL

1973 "Water Supply and Wastewater Reclamation." Grand Canyon National Park.

ROCKRISE, ODERMATT, MOUNTJOY, AMIS

1974 "Program, South Rim Village, Grand Canyon National Park."

U.S. DEPARTMENT OF THE INTERIOR, NATIONAL PARK SERVICE

1975 Final Environmental Statement for the Master Plan, Grand Canyon National Park.

1976 Final Environmental Statement for the Development Concept Plan, Grand Canyon National Park.

1977 Development Concept Plan, Grand Canyon National Park.

1978 Special Study, Capacity Analysis/Water Alternatives, Grand Canyon National Park.

1983 Engineering Study, Replace Water Distribution System, Village Area, Grand Canyon National Park.

SECRET

John Latschar, Cultural Resource Specialist, Denver Service Center

U.S. Fish and Wildlife Service

Don Metz, Threatened and Endangered Species Specialist

Tom Van Devender, Botanist

Dave Roe, Wildlife Specialist

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Richard Marks, Superintendent

Bruce Shaw, Assistant Superintendent

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REFERENCE LIBRARY
GRAND CANYON
NATIONAL PARK